

ZERO VALENT IRON PILOT STUDY

Jeff Dale

PROJECT LOCATION:

Naval Air Warfare Center

Trenton, (Ewing Township) NJ

Project Goal

- **Hot Spot Ground Water Treatment**

Base Description

- **Jet Engine Test Facility**
- **Trichloroethylene (TCE) used as heat exchange fluid**
- **25,000 gallon system**
- **numerous surface spills**
- **Clay over fractured sedimentary bedrock**
- **DNAPL Strongly suspected, but never confirmed**

Regulatory Framework

- **non-NPL**
 - **NJDEP Lead Regulator**
 - **Good relationship with BCT**
 - **Good community relations**
 - **Closed under BRAC 93**
 - **Public sale in late 98**
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Pilot Site Description 1996

- **Monitoring Well 36BR**
- **136 ft deep, low yield**
- **up to 8,900 ppm TCE**
- **Consistently 300-400 ppm**
- **Well is adjacent to Pump and Treat Building**
- **Pump and Treat oversized for future expansion**
- **Plant has operator and field GC**

Pilot Study Background

- **Regulators suggested hot spot treatment**
- **Contaminants at very high levels**
- **NorthDiv in house literature search for technologies that could treat this hot spot from 100 ppm to 100 ppb**
- **Zero valent Iron showed promise at Waterloo**

Zero Valent Iron

- **Iron catalyzes a reaction to dechlorinate compounds**
- **Iron donates electron**
- **Research stage, with few implementations**
- **Iron is basically foundry scrap**

Literature Review

- **NFESC provided copies of 50 relevant journal articles for review**
- **“Back of Envelope” Design scaled up from published data**
- **Need 188 kg of iron (400 lbs)**

Phase 1 mid 1997

- **NorthDiv tasked Foster Wheeler to implement**
- **Iron from Coast Guard site in NC**
- **Bladder pump in Well 36BR**
- **Above grade pipe to building**
- **1 gpm initial Q**

Phase 1 Results

- **Not very promising, 10-40 % removal**
- **Lowered Q to 0.05 gpm, 25-80% removal**
- **Reviewed Design with new data on iron reaction rates**
- **Plant undersized**

Waterloo Connection

- **Met staff of EnviroMetal Technologies at Waterloo**
- **EMT provides consulting services for in or ex-situ reactive media**
- **Consulting for Coast Guard wall in NC**
- **Also consulting for EPA SITE in Wayne NJ**
- **Utilized software models of reaction rates, confirmed sizing problem**
- **Proposed using Nickel plated iron in parallel with Wayne NJ SITE**

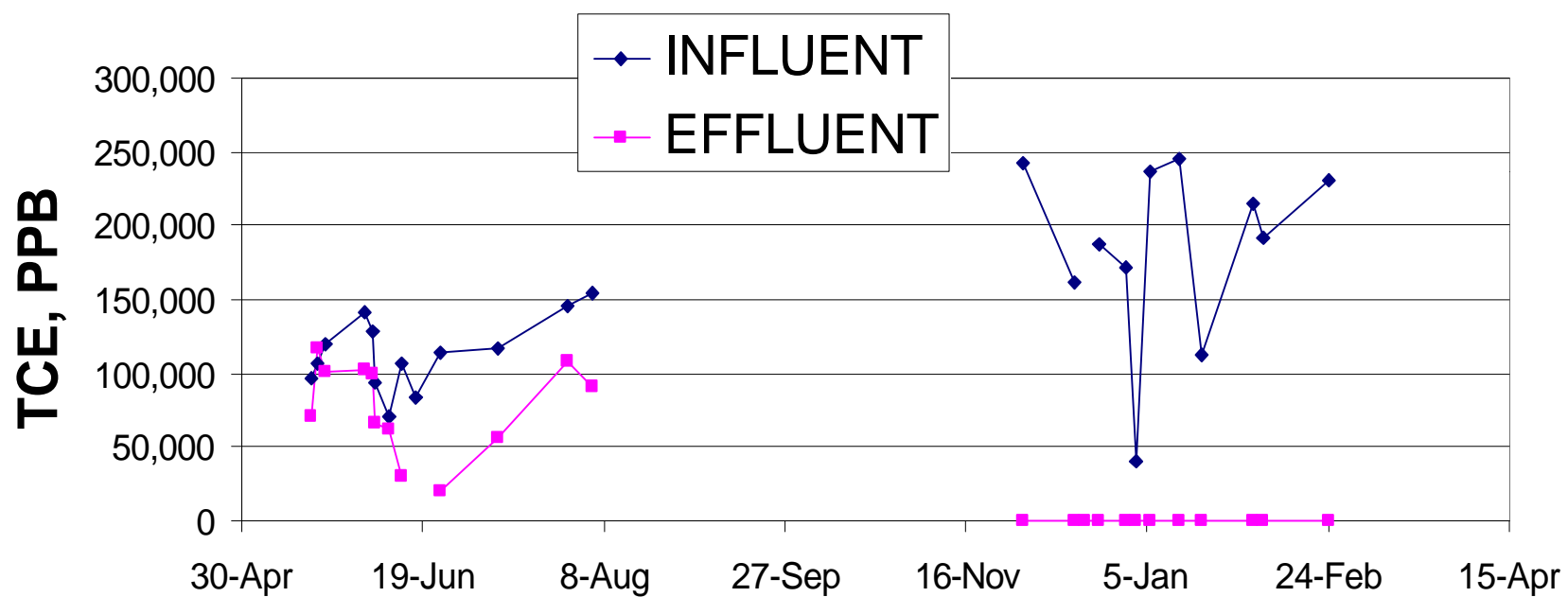
Phase 2 late 1997

- **Obtained Nickel-plated Iron in 11/97
\$2500/ton**
- **Restart 12/97 at 0.05 gpm**

Phase 2 con't

- **99+% removal**
 - **90 day study without problem**
 - **Pilot plant shut down for Plant upgrade for final remedy**
 - **Total TCE removal of 3.2+ pounds**
 - **Well 36 BR stabilizing below 250 ppm**
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WELL 36 BR IRON FILINGS PILOT



Cost

- **Phase 1...\$25,000 Phase 2...\$25,000**
- **Average of \$16,000/pound**
- **Includes extra lab work for pilot study**
- **Compare with the ground water treatment plant at the base**
 - **12 gpm at 140 ppm**
 - **\$4,000,000 for 5000 pounds TCE**
 - **or \$800/pound**

Future

- **Nickel Iron Reactor to continue use indefinitely**
 - **Continue Mass Removal**
 - **Evaluate Long term use of Nickel doped Iron**
- **Cost per pound of contaminant will continue to drop**
- **Low operational cost**

Summary

- **Mass removal**
- **Successfully treated hot spot**
- **Demonstrated an emerging technology**
 - **Regular Zero valent Iron**
 - **Nickel Enhanced Iron**





